1997 Index of Articles

Volume XL

Journal of the Institute of Environmental Sciences

SUBJECT INDEX

CONTAMINATION CONTROL (CC)

Clean Facility Design/Materials

Computational Modeling of Airflow, *A. Tannous*, V. 40, No. 1, p. 29, 1997.

Isolation Ratio and Particle Performance Measurement of a SMIF System, *B. Liu, S. Yoo*, V. 40, No. 6, p. 23, 1997.

N2 Tunnel Wafer Transport System, *M. Toda, T. Ohmi, T. Nitta, Y. Saito, Y. Kanno, M. Umeda, M. Yagai, H. Kidokoro*, V, 40, No. 1, p. 23, 1997.

On Generic Vibration Criteria for Advanced Technology Facilities, *H. Amick*, V. 40, No. 5, p. 35, 1997.

Clean Facility Operation/Procedures

In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, *J. Wei, J. Pillion, C. Hoang*, V. 40, No. 2, p. 43, 1997.

Instrument Design for Sub-PPB Oxygenated Contaminants Detection in Semiconductor Processing, *K. Man, S. Boumsellek*, V. 40, No. 4, p. 17, 1997.

Isolation Ratio and Particle Performance Measurement of a SMIF System, *B. Liu, S. Yoo*, V. 40, No. 6, p. 23, 1997.

Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, *J. Skoufis, C. Africk, D. Cooper*, V. 40, No. 3, p. 28, 1997.

N2 Tunnel Wafer Transport System, *M. Toda, T. Ohmi, T. Nitta, Y. Saito, Y. Kanno, M. Umeda, M. Yagai, H. Kidokoro*, V., 40, No. 1, p. 23, 1997.

Rinsing: A Critical Process in Contamination Control, *K. Christenson*, V. 40, No. 5, p. 45, 1997.

Criteria and Standards

Considerations Regarding the Statistics of Particle Counting, *T. Bzik*, V. 40, No. 4, p. 29, 1997.

On Generic Vibration Criteria for Advanced Technology Facilities, *H. Amick*, V. 40, No. 5, p. 35, 1997.

Statistical Monitoring Techniques for Contamination Data, *D. Montgomery, J. Keats, J. Fowler, G. Runger, G. Rajavelu*, V. 40, No. 2, p. 23, 1997.

Identification, Measurement, and Monitoring

Considerations Regarding the Statistics of Particle Counting, *T. Bzik*, V. 40, No. 4, p. 29, 1997.

In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, *J. Wei, J. Pillion, C. Hoang*, V. 40, No. 2, p. 43, 1997.

Instrument Design for Sub-PPB Oxygenated Contaminants Detection in Semiconductor Processing, *K. Man, S. Boumsellek*, V. 40, No. 4, p. 17, 1997.

Minimum Sampling Time/Volume for Liquide-Borne Particle Counters and Monitors, *M. Xu, H. Wang*, V. 40, No. 6, p. 29, 1997.

Statistical Monitoring Techniques for Contamination Data, *D. Montgomery, J. Keats, J. Fowler, G. Runger, G. Rajavelu*, V. 40, No. 2, p. 23, 1997.

Toward Classification of Particle Properties Using Light Scattering Techniques, *T. Warner, E. Hirleman*, V. 40, No. 3, p. 15, 1997.

Modeling and Simulation

Computational Modeling of Airflow, *A. Tannous*, V. 40, No. 1, p. 29, 1997.

Sources and Effects

Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, *J. Skoufis, C. Africk, D. Cooper*, V. 40, No. 3, p. 28, 1997.

DESIGN, TEST, AND EVALUATION (DTE)

Acoustics

Lessons Learned in Predicting Launch Vehicle Vibroacoustic Environments, *C. Tanner*, V. 40, No. 2, p. 38, 1997.

Automotive/Transportation

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, pp. 15, 1997.

Correlation of a Sinusoidal Sweep Test to Field Random Vibration, *J. Hu*, V. 40, No. 6, p. 35 1997.

Shaker Simulation of Random Vibration with a High Kurtosis Value, *A. Steinwolf*, V. 40, No. 3, p. 33, 1997.

The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, *W. Connon*, V. 40, No. 2, p. 31, 1997.

Climatics and Thermal

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, p. 15, 1997.

1997 Index of Articles

Volume XL

Journal of the Institute of Environmental Sciences

SUBJECT INDEX

CONTAMINATION CONTROL (CC)

Clean Facility Design/Materials

Computational Modeling of Airflow, *A. Tannous*, V. 40, No. 1, p. 29, 1997.

Isolation Ratio and Particle Performance Measurement of a SMIF System, *B. Liu, S. Yoo*, V. 40, No. 6, p. 23, 1997.

N2 Tunnel Wafer Transport System, *M. Toda, T. Ohmi, T. Nitta, Y. Saito, Y. Kanno, M. Umeda, M. Yagai, H. Kidokoro*, V, 40, No. 1, p. 23, 1997.

On Generic Vibration Criteria for Advanced Technology Facilities, *H. Amick*, V. 40, No. 5, p. 35, 1997.

Clean Facility Operation/Procedures

In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, *J. Wei, J. Pillion, C. Hoang*, V. 40, No. 2, p. 43, 1997.

Instrument Design for Sub-PPB Oxygenated Contaminants Detection in Semiconductor Processing, *K. Man, S. Boumsellek*, V. 40, No. 4, p. 17, 1997.

Isolation Ratio and Particle Performance Measurement of a SMIF System, *B. Liu, S. Yoo*, V. 40, No. 6, p. 23, 1997.

Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, *J. Skoufis, C. Africk, D. Cooper*, V. 40, No. 3, p. 28, 1997.

N2 Tunnel Wafer Transport System, *M. Toda, T. Ohmi, T. Nitta, Y. Saito, Y. Kanno, M. Umeda, M. Yagai, H. Kidokoro*, V., 40, No. 1, p. 23, 1997.

Rinsing: A Critical Process in Contamination Control, *K. Christenson*, V. 40, No. 5, p. 45, 1997.

Criteria and Standards

Considerations Regarding the Statistics of Particle Counting, *T. Bzik*, V. 40, No. 4, p. 29, 1997.

On Generic Vibration Criteria for Advanced Technology Facilities, *H. Amick*, V. 40, No. 5, p. 35, 1997.

Statistical Monitoring Techniques for Contamination Data, *D. Montgomery, J. Keats, J. Fowler, G. Runger, G. Rajavelu*, V. 40, No. 2, p. 23, 1997.

Identification, Measurement, and Monitoring

Considerations Regarding the Statistics of Particle Counting, *T. Bzik*, V. 40, No. 4, p. 29, 1997.

In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, *J. Wei, J. Pillion, C. Hoang*, V. 40, No. 2, p. 43, 1997.

Instrument Design for Sub-PPB Oxygenated Contaminants Detection in Semiconductor Processing, *K. Man, S. Boumsellek*, V. 40, No. 4, p. 17, 1997.

Minimum Sampling Time/Volume for Liquide-Borne Particle Counters and Monitors, *M. Xu, H. Wang*, V. 40, No. 6, p. 29, 1997.

Statistical Monitoring Techniques for Contamination Data, *D. Montgomery, J. Keats, J. Fowler, G. Runger, G. Rajavelu*, V. 40, No. 2, p. 23, 1997.

Toward Classification of Particle Properties Using Light Scattering Techniques, *T. Warner, E. Hirleman*, V. 40, No. 3, p. 15, 1997.

Modeling and Simulation

Computational Modeling of Airflow, *A. Tannous*, V. 40, No. 1, p. 29, 1997.

Sources and Effects

Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, *J. Skoufis, C. Africk, D. Cooper*, V. 40, No. 3, p. 28, 1997.

DESIGN, TEST, AND EVALUATION (DTE)

Acoustics

Lessons Learned in Predicting Launch Vehicle Vibroacoustic Environments, *C. Tanner*, V. 40, No. 2, p. 38, 1997.

Automotive/Transportation

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, pp. 15, 1997.

Correlation of a Sinusoidal Sweep Test to Field Random Vibration, *J. Hu*, V. 40, No. 6, p. 35 1997.

Shaker Simulation of Random Vibration with a High Kurtosis Value, *A. Steinwolf*, V. 40, No. 3, p. 33, 1997.

The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, *W. Connon*, V. 40, No. 2, p. 31, 1997.

Climatics and Thermal

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, p. 15, 1997.

Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, *K. Cluff, D. Robbins, T. Edwards, D. Barker*, V. 40, No. 4, p. 22, 1997.

Mars Pathfinder Spacecraft, Lander, and Rover Testing in Simulated Deep Space and Mars Surface Environments, *K. Johnson*, V. 40, No. 5, p. 17, 1997.

Criteria and Standards

On Generic Vibration Criteria for Advanced Technology Facilities, *H. Amick*, V. 40, No. 5, p. 35, 1997.

Shaker Simulation of Random Vibration with a High Kurtosis Value, *A. Steinwolf*, V. 40, No. 3, p. 33, 1997.

Test Philosophies for the New Millennium, *T. Larson, J. Newell*, V. 40, No. 3, p. 22, 1997.

The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, *W. Connon*, V. 40, No. 2, p. 31, 1997.

Shock and Vibration

A Method for Implementing Force-Limited Vibration Control, *D. Worth*, V. 40, No. 4, p. 34, 1997.

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, p. 15, 1997.

Characterizing Electrodynamic Shakers as a Two-Port Network, *D. Smallwood*, V. 40, No. 5, p. 27, 1997.

Correlation of a Sinusoidal Sweep Test to Field Random Vibration, *J. Hu*, V. 40, No. 6, p. 35, 1997.

Lessons Learned in Predicting Launch Vehicle Vibroacoustic Environments, *C. Tanner*, V. 40, No. 2, p. 18, 1997.

Multi-Resolution Processing for Random Vibration Control, *A. Karshenas, M. Dunnigan, B. Williams, J. Goodfollow*, V. 40, No. 1, p. 35, 1997.

Lessons Learned in Predicting Launch Vehicle Vibroacoustic Environments, *C. Tanner*, V. 40, No. 2, p. 18, 1997.

On Generic Vibration Criteria for Advanced Technology Facilities, *H. Amick*, V. 40, No. 5, p. 35, 1997.

Shaker Simulation of Random Vibration with a High Kurtosis Value, *A. Steinwolf*, V. 40, No. 3, p. 33, 1997.

Test Philosophies for the New Millennium, *T. Larson, J. Newell*, V. 40, No. 3, p. 22, 1997.

The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, *W. Connon*, V. 40, No. 2, p. 31, 1997.

Solar and Space Simulation

Mars Pathfinder Spacecraft, Lander, and Rover Testing in Simulated Deep Space and Mars Surface Environments, *K. Johnson*, V. 40, No. 5, p. 17, 1997.

Test Tailoring

A Check List for Developing Accelerated Reliability Tests, *H. Caruso*, V. 40, No. 1, p. 41, 1997.

A Method for Implementing Force-Limited Vibration Control, *D. Worth*, V. 40, No. 4, p. 34, 1997.

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, p. 15, 1997.

Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, *K. Cluff, D. Robbins, T. Edwards, D. Barker*, V. 40, No. 4, p. 22, 1997.

Lessons Learned in Predicting Launch Vehicle Vibroacoustic Environments, *C. Tanner*, V. 40, No. 2, p. 38, 1997.

Mars Pathfinder Spacecraft, Lander, and Rover Testing in Simulated Deep Space and Mars Surface Environments, *K. Johnson*, V. 40, No. 5, p. 17, 1997.

Multi-Resolution Processing for Random Vibration Control, *A. Karshenas, M. Dunnigan, B. Williams, J. Goodfollow*, V. 40, No. 1, p. 35, 1997.

Shaker Simulation of Random Vibration with a High Kurtosis Value, *A. Steinwolf*, V. 40, No. 3, p. 33, 1997.

Test Philosophies for the New Millennium, *T. Larson, J. Newell*, V. 40, No. 3, p. 22, 1997.

The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, *W. Connon*, V. 40, No. 2, p. 31, 1997.

Test Time Compression

A Check List for Developing Accelerated Reliability Tests, *H. Caruso*, V. 40, No. 1, p. 41, 1997.

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, p. 15, 1997.

Correlation of a Sinusoidal Sweep Test to Field Random Vibration, *J. Hu*, V. 40, No. 6, p. 35, 1997.

The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, *W. Connon*, V. 40, No. 2, p. 31, 1997.

PRODUCT RELIABILITY (PR)

Acquisition Policies

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, p. 15, 1997.

Durability/Fatigue

A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, *D. Aldridge*, V. 40, No. 6, pp. 15, 1997.

Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, *K. Cluff, D. Robbins, T. Edwards, D. Barker*, V. 40, No. 4, p. 22, 1997.

Correlation of a Sinusoidal Sweep Test to Field Random Vibration, *J. Hu*, V. 40, No. 6, p. 35, 1997.

Reliability Achievement

Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, *K. Cluff, D. Robbins, T. Edwards, D. Barker*, V. 40, No. 4, p. 22, 1997.

Test Philosophies for the New Millennium, *T. Larson, J. Newell*, V. 40, No. 3, p. 22, 1997.

(continued on following page)

AUTHOR INDEX

A

Africk, C.A., Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, V. 40, No. 3, p. 28, 1997. (Abstract—see Skoufis, J.)

Aldridge, D.S., A Strategy to Integrate the 'Tailoring' and 'Simulation' Test Philosophies, V. 40, No. 6, p. 15, 1997. *This paper considers the benefits and liabilities of the tailoring and stimulation test philosophies. It introduces a hybrid strategy to link the tailoring and stimulation test philosophies into an integrated philosophy with implementation examples. A methodology to create generic environmental requirements through Weibull analysis of historical databases is presented. The implications in the hybrid philosophy are discussed along with reliability demonstration considerations. Examples of product requirements are provided for vibration and thermal environments.* (DTE: Automotive/Transportation, Climatics and Thermal, Shock and Vibration, Test Tailoring, Test Time Compression; PR: Acquisition Policies, Durability/Fatigue)

Amick, H., On Generic Vibration Criteria for Advanced Technology Facilities with a Tutorial on Vibration Data Representation, V. 40, No. 5, p. 35, 1997. *The design of vibration-sensitive advanced technology facilities generally involves considerable attention to structural and mechanical aspects. In most cases, the vibration control measures contribute significantly to a facility's cost. The selection of a vibration criterion for use in design is an important step in the design process. Many process equipment manufacturers have provided tool-specific criteria, and the literature contains several forms of "generic" criteria. Unfortunately, there is no standardization in either tool-specific or generic criteria, and considerable confusion can arise, often due to the forms of data representation used. This paper first reviews some of the relevant fundamentals of signal processing, then uses experimental data to develop a tool-specific vibration criterion for an optical microscope. Two dissimilar approaches to generic criteria are discussed, and their signal-processing requirements are examined. They are compared with a manufacturer's published vibration criteria for a projection aligner. Recommendations are given for future development of tool-specific criteria.* (CC: Clean Facility Design/Materials, Criteria and Standards; DTE: Criteria and Standards, Shock and Vibration))

B

Barker, D.B., Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, V. 40, No. 4, p. 22, 1997. (Abstract—see Cluff, K.D.)

Boumsellek, S., Instrument Design for Sub-PPB Oxygenated Contaminants Detection in Semiconductor Processing, V. 40, No. 4, p. 17, 1997. (Abstract—see Man, K.F.)

Bzik, T.J., Considerations Regarding the Statistics of Particle Counting, V. 40, No. 4, p. 29, 1997. *The control of particulate contamination is integral to many semiconductor manufacturing processes. In these processes, particle contamination levels are measured and compared with performance standards and statistically analyzed to determine the process state. Such particle data often exhibit a high relative standard deviation. This impacts the ability to make appropriate decisions about the state of process cleanliness. Further compounding the problem is that traditional statistical tools (e.g., normality assumption, Shewhart control charts) may perform poorly when applied to particle data. This paper presents an overview of many key issues surrounding the application and misapplication of statistical methods to particle data.* (CC: Criteria and Standards, Identification, Measurement, and Monitoring)

C

Caruso, H., A Check List for Developing Accelerated Reliability Tests, V. 40, No. 1, p. 41, 1997). *This paper provides the newcomer to or casual practitioner of environmental reliability testing with an integrated overview of important issues and considerations associated with accelerated reliability testing. These include step-stress testing, durability test-time compression, and environmental stress screening. Other issues include the purpose of the test, the information needs of the customer, and the optimum level of assembly for testing. This information is presented in the form of a question and answer thought process that can be applied in commercial or military test situations.* (DTE: Test Tailoring, Test Time Compression; PR: Durability/Fatigue)

Christenson, K.K., Rinsing: A Critical Process in Contamination Removal, V. 40, No. 5, p. 45, 1997. *The rinsing process of silicon wafers is normally carried out in an "overflow" bath in which water flows past the wafers at average velocity of 1 cm/s. But the velocity is zero at the wafer surface. The efficiency of rinsing is limited by the rate at which contaminants diffuse away from the silicon surface and into the flow stream. This paper reports the improvement in rinsing efficiency gained by repeating a 1-min cycle of first allowing the contaminants to diffuse into the stagnant layer and then "dumping" the rinse tank to remove most of the contaminated stagnant layer. A further 10-fold improvement in rinsing efficiency per rinse cycle can be achieved by spinning the wafer and using centrifugal force to remove a greater fraction of the stagnant layer. This allows the complete removal of soluble contaminants with a 20-fold reduction in water usage compared to present immersion techniques.* (CC: Clean Facility Operation/Procedures)

Cluff, K.D., Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, V. 40, No. 4, p. 22, 1997. *Defining environmental loading is often the most uncertain part of the electronics reliability calculation. This paper demonstrates a practical methodology to measure and characterize the dynamic thermal history of the commercial airplane environment. To reduce irregular field thermal cycles, an algorithm is presented that preserves key information necessary for viscoplastic solder fatigue analysis. As an example, the IPC solder model will be used to evaluate 20 termination leadless ceramic chip carriers on nonconstrained printed wiring boards. This methodology will enable more realis-*

tic thermal fatigue reliability assessments and acceleration test specifications. (DTE: Climatics and Thermal, Test Tailoring; PR: Durability/Fatigue, Reliability Achievement)

Connon, W.H. III, The Origin of the Composite Wheeled Vehicle, Two-Wheeled Trailer, and Tracked Vehicle Vibration Schedules in MIL-STD-810D/E, V. 40, No. 2, p. 31, 1997. *In the early and mid-1980s, a concerted effort was made at the Aberdeen Test Center to collect vibration data on a variety of vehicles to create laboratory vibration test schedules. The initial schedules were published in MIL-STD-810D and were updated in MIL-STD-810E and ITOP (International Test Operations Procedure) 1-2-601. Although the vehicles used for schedule development are listed in the documents and a test scenario is described, little information has been published describing how the test levels compare with the actual measured levels and how the test courses used compare with the terrain likely to be encountered in the vehicle's normal operation. This paper describes the data acquisition and analysis efforts to show where and how measurements were made and how the final test levels relate to the actual measured levels. It also describes the test courses used and show how they relate to "civilian sector" conditions such as operation on an unpaved road. This paper provides an understanding of the physical severity represented by the test procedures used and the amount of conservatism and level exaggeration (to reduce test time) built into the schedule development process.* (DTE: Automotive/Transportation, Criteria and Standards, Shock and Vibration, Test Tailoring, Test Time Compression)

Cooper, D.W., Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, V. 40, No. 3, p. 28, 1997. (Abstract—see Skoufis, J.)

D

Dunnigan, M.W., Multi-Resolution Processing for Random Vibration Control, V. 40, No. 1, p. 35, 1997. (Abstract—see Karshenas, A.M.)

E

Edwards, T., Characterizing the Commercial Avionics Thermal Environment for Field Reliability Assessment, V. 40, No. 4, p. 22, 1997. (Abstract—see Cluff, K.D.)

F

Fowler, J.W., Statistical Monitoring Techniques for Contamination Data, V. 40, No. 2, p. 23, 1997. (Abstract—see Montgomery, D.C.)

G

Goodfollow, J.K., Multi-Resolution Processing for Random Vibration Control, V. 40, No. 1, p. 35, 1997. (Abstract—see Karshenas, A.M.)

H

Hirleman, E.D., Toward Classification of Particle Properties Using Light Scattering Techniques, V. 40, No. 3, p. 15, 1997. (Abstract—see Warner, T.L.)

Hoang, C., In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, V. 40, No. 2, p. 43, 1997. (Abstract—see Wei, J.)

Hu, J.M., Correlation of a Sinusoidal Sweep Test to Field Random Vibration, V. 40, No. 6, p. 35, 1997. *This paper presents a method for transferring the measured field random vibration into a sinusoidal sweep test by using the damage equivalence technique. This requires the fatigue damage generated in the sinusoidal sweep to be equivalent to the damage during the desired lifetime in the field operation. Based on this approach, a correlated lab-test specification, including the vibration level and test duration, can be determined according to the field random load input, the desired product life goal of a product, and the material/structural properties. If a generic test specification is required without knowing the material/structural properties, an approximate approach is proposed based on some engineering assumptions. In this paper, the development of a test specification for an automotive bracket is demonstrated as an application example.* (DTE: Automotive/Transportation, Shock and Vibration, Test Time Compression; PR: Durability/Fatigue)

J

Johnson, K.R., Mars Pathfinder Spacecraft, Lander, and Rover Testing in Simulated Deep Space and Mars Surface Environments, V. 40, No. 5, p. 17, 1997. *The Mars Pathfinder (MPF) spacecraft was built and tested at the Jet Propulsion Laboratory during 1995 and 1996. MPF was launched December 4, 1996, and successfully landed on Mars on July 4, 1997. The testing program required that the mission hardware be subjected to both deep space and Mars surface conditions. A series of tests were devised and conducted from January, 1995, to July, 1996, to study the thermal response of the MPF spacecraft to the environmental conditions to which it was to be exposed during the cruise phase (on the way to Mars) and the lander phase (landed on Mars). In addition, several tests were conducted to study the thermal characteristics of the Mars rover, Sojourner, under Mars surface environmental conditions. Several special test fixtures and methods were devised to simulate the required environmental conditions. This paper describes the MPF test program conducted at JPL to verify the MPF thermal design.* (DTE: Climatics and Thermal, Solar and Space Simulation, Test Tailoring)

K

Kanno, Y-I., N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

Karshenas, A.M., Multi-Resolution Processing for Random Vibration Control, V. 40, No. 1, p. 35, 1997. *A typical vibration test for a specimen is to subject it to a specific spectrum of random vibration. This paper proposes multi-resolution processing using a "Frequency Domain Self-Tuning" algorithm for application to random vibration control. MATLAB programs simulate two-octave-band and three-octave-band processing for random vibration control. A PC-based DSP board was used to implement two-octave processing. The simulation and practical re-*

sults are presented. (DTE: Shock and Vibration, Test Tailoring)

Keats, J.B., Statistical Monitoring Techniques for Contamination Data, V. 40, No. 2, p. 23, 1997. (Abstract—see Montgomery, D.C.)

Kidokoro, H., N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

L

Larson, T.W., Test Philosophies for the New Millennium, V. 40, No. 3, p. 22, 1997. *This paper describes current research at the Jet Propulsion Laboratory (JPL) directed toward the optimization of future spacecraft testing. Force-limited vibration studies, conducted during several recent space vehicle programs, have been extremely successful in improving the quality and realism of hardware trials. Single versus tri-axial vibration research is also in progress, with a similar objective of test realism enhancement. In addition, use of the Environmental Test Effectiveness Assessment (ETEA) process has helped to identify those tests which most effectively isolate hardware defects. In an effort to streamline the development of requirements, JPL has recently begun to establish a "2-sigma" generic environmental envelope. In the future, such an envelope could allow "off-the-shelf" hardware to be flown on a number of standard launch vehicles. In a related study, the Accurate, Cost Effective Qualification (ACEQ) program has been developed to correlate system requirements with failure modes, and then assess the effectiveness of test, analysis and process control in identifying these modes.* (DTE: Criteria and Standards, Shock and Vibration, Test Tailoring; PR: Reliability Achievement)

Liu, B.Y.H., Isolation Ratio and Particle Performance Measurement of a SMIF System, V. 40, No. 6, p. 23,1997. *This paper discusses the performance evaluation of a SMIF (Standard Mechanical Interface) system. A two-chamber experimental system is used with one chamber providing the test atmosphere of the cleanroom and the other providing the test atmosphere of the minienvironment. The cleanroom atmosphere can be varied by adjusting the amount of particles injected into the chamber. Particle concentration ranges from 1,000/ft^3 to 10 million/ft^3 can be created in the chamber to simulate different cleanroom conditions. The atmosphere of the second chamber is maintained at Class 1 or better equivalent by means of a self-powered ultra-low penetration air (ULPA) filter blower unit. By means of this system, the ability of the SMIF system to isolate the contaminants in the cleanroom atmosphere from the minienvironment atmosphere was measured. In addition, the particles added to the wafer during wafer cassette handling by the SMIF-Arm were also measured by a wafer scanner.* (CC: Clean Facility Design/Materials, Clean Facility Operation/Procedures)

M

Man, K.F., Instrument Design for Sub-PPB Oxygenated Contaminants Detection in Semiconductor Processing, V. 40, No. 4, p. 17, 1997. *This paper describes a technique for measuring trace quantities of oxygen and moisture contaminants present in a semiconductor and/or containerless processing environment. Monatomic negative oxygen ions, O^-, formed by electron dissociative attachment through interaction with the molecular oxygen and water, are measured to infer the presence of the contaminants. This technique exploits the fact that the cross section for the reaction is greatly enhanced at the resonant energy. The device built to demonstrate this technique combines a small gridded electron ionizer with a conventional mass spectrometer. The concentrations of oxygen have been measured using the method of standard additions by diluting O_2 in N_2. The lowest detection limit obtained was 1.2 kHz (O^- count rate) at a concentration of 10^{-10}, corresponding to 0.1 ppb. Sensitivity calculations for detecting moisture, and electron and ion trajectory modeling using the SIMION program are presented. The detection of trace quantities of water vapor was attempted. The difficulties with handling water in the experiments are also described.* (CC: Clean Facility Operation/Procedures, Identification, Measurement, and Monitoring)

Montgomery, D.C., Statistical Monitoring Techniques for Contamination Data, V. 40, No. 2, p. 23, 1997. *Monitoring of particle contamination by statistically based methods is used extensively in semiconductor manufacturing. Often Shewhart-type charts are used for this purpose. These charts suffer from some potential disadvantages in this application environment. Specifically, they are slow to detect shifts or changes in the level of particle contamination and, in some situations, the underlying statistical assumptions of the charts are inappropriate for contamination data. The use of cumulative sum and exponentially weighted moving average control charts for monitoring particle contamination are suggested. The advantages of these charts for the types of particle contamination data typically encountered in semiconductor manufacturing are discussed and illustrated with examples.* (CC: Criteria and Standards, Identification, Measurement, and Monitoring)

N

Newell, J.M., Test Philosophies for the New Millennium, V. 40, No. 3, p. 22, 1997. (Abstract—see Larson, T.W.)

Nitta, T., N2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

O

Ohmi, T., N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

P

Pillion, J., In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, V. 40, No. 2, p. 43, 1997. (Abstract—see Wei, J.)

R

Rajavelu, G., Statistical Monitoring Techniques for Contamination Data, V. 40, No. 2, p. 23, 1997. (Abstract—see Montgomery, D.C.)

Robbins, D., Characterizing the Commercial Avionics Ther-

mal Environment for Field Reliability Assessment, V. 40, No. 4, p. 22, 1997. (Abstract—see Cluff, K.D.)

Runger, G.C., Statistical Monitoring Techniques for Contamination Data, V. 40, No. 2, p. 23, 1997. (Abstract—see Montgomery, D.C.)

S

Saito, Y., N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

Skoufis, J., Low-Contamination Fabric Tapes for Disk Polishing, Texturing, and Buffing, V. 40, No. 3, p. 28, 1997. *Fabric tapes are used in many areas of magnetic media (thin-film disk) preparation in the data storage industry: polishing, texturing, and lube buffing. Tapes are more commonly used than pads for such applications, partly because the continuous supply of new tape during operation provides improved uniformity compared to the inherent discontinuities involved in pad conditioning/use/conditioning/use. An important quality issue (in addition to reproducibility, uniformity, and planarity) is contamination control. Contamination by particles will be even more important as slider flying heights are reduced. Molecular contaminants are also important because some species can lead to the loss of lubricant on areas of the disk. Ionic species adsorb water preferentially from the air and thus can accelerate corrosion. Steps taken to minimize fabric contamination include careful selection of starting materials, control of the processing environment and processing variables, and cleaning the fabrics before they are made into tapes. New tape materials are likely to give new operating options, as well as new quality control problems, and some of these are discussed.* (CC: Clean Facility Operation/Procedures, Sources and Effects)

Smallwood, D.O., Characterizing Electrodynamic Shakers as a Two-Port Network, V. 40, No. 5, p. 27, 1997. *An electrodynamic shaker is modeled as a mixed electrical/mechanical system with an experimentally derived two-port network characterization. The model characterizes the shaker in a manner that the performance of the shaker with a mounted load (test item and fixture) can be predicted. The characterization depends on the measurements of shaker input voltage and current, and on the acceleration of the shaker armature with several mounted loads. The force into the load is also required and can be measured directly or inferred from the load apparent mass.* (DTE: Shock and Vibration)

Steinwolf, A., Shaker Simulation of Random Vibration with a High Kurtosis Value, V. 40, No. 3, p. 33, 1997. This *paper presents a vibration test technique for extending the tails of amplitude probability distribution beyond the Gaussian values as is characteristic for vibration of ground vehicles on a rough road or terrain. The method proposed uses the commonly accepted approach of applying pseudorandom excitation in the form of a Fourier expansion. The procedure described in this paper can be implemented by updating currently available digital vibration controllers. The solution for amplitude domain fitting is based on an analytical expression derived for the kurtosis parameter of the polyharmonic process in terms of amplitudes and phase angles for any number of harmonic components. The results of theoretical analysis are embodied in software subjected to verification in computer and experimental tests. Even with additional kurtosis control, the closeness of the generated and desired spectra is the same as for the Gaussian simulation of power spectral density. Hence, this new technique for amplitude domain matching is not accompanied by the deterioration of ordinary test capabilities in the frequency domain.* (DTE: Automotive Transportation, Criteria and Standards, Shock and Vibration, Test Tailoring)

T

Tanner, C.S., Lessons Learned in Predicting Launch Vehicle Vibroacoustic Environments, V. 40, No. 2, p. 38, 1997. *Lessons learned in predicting the vibroacoustic environments for launch vehicles are reviewed. Elements cover prediction methods, ground test experiences, use of flight data in extrapolating environments, and flight data results for DoD launch vehicle systems.* (DTE: Acoustics, Shock and Vibration, Test Tailoring)

Tannous, A.G., Computational Modeling of Airflow in a Minienvironment, V. 40, No. 1, p. 29, 1997. *This paper describes the use of a CFD (computational fluid dynamics) code, for the design and optimization processes of a minienvironment, mounted on a wafer process tool. The three-dimensional code predicts the air velocity field and pressure distribution based on a finite volume approach. The geometric model consists of the minienvironment, the tool surface, and the integrated I/O indexer interfaces. The airflow in the minienvironment (with a conceptual design configuration) was simulated. The results prompted a design change. The new design has a desirable airflow for more effective minienvironment performance. Particular attention was paid to air recirculation zones that could potentially trap particles generated during the process and to maintaining a positive differential pressure to prevent cross-contamination. CFD was shown to be an important step in the design process.* (CC: Clean Facility Design/Materials, Modeling and Simulation)

Toda, M., *N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. This paper describes a wafer transport system developed for application to the next generation of ULSI manufacturing processes. Various types of wafers ranging from 8 in. to 12 in. are floated on a gas film to be transported through an ultraclean N_2 gas environment with no solid contact. A sensor controls the movement of the transported wafer precisely and rapidly. It instantly detects and recognizes the configuration of the wafer and lets the wafer stop, facing in the right direction. In this ultraclean N_2 gas environment, the wafer surface is free from particle contamination and growth of native oxide. Furthermore, moving the electrostatic clamping device on the track, and the jet flow of ultraclean N2 gas against the track, allows self-cleaning of the wafer transport track.* (CC: Clean Facility Design/Materials, Clean Facility Operation/Procedures)

U

Umeda, M., N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

W

Wang, H-C., Minimum Sampling Time/Volume for Liquide-Borne Particle Counters, V. 40, No. 6, p. 29, 1997. (Abstract—see Xu, M.)

Warner, T.L., Toward Classification of Particle Properties Using Light Scattering Techniques, V. 40, No. 3, p. 15, 1997. *The success of the semiconductor industry's quest for contamination-free manufacturing depends heavily on the continued evolution of wafer scanners and other analytical instruments. The ability to characterize (rather than simply detect) a contaminant particle on a surface using light scattering techniques would be utilized by future instruments. The research described in this article provides a fundamental knowledge base necessary for particle characterization using laser-based light scattering. An algorithm to provide some discrimination of both particle size and composition was developed and demonstrated.* (CC: Identification, Measurement, and Monitoring)

Wei, J., In-Line Moisture Monitoring in Semiconductor Process Gases by a Reactive-Metal-Coated Quartz Crystal Microbalance, V. 40, No. 2, p. 43, 1997. *A new in-line sensor for trace moisture monitoring has been developed based on a piezoelectric quartz crystal microbalance (QCM) coated with a reactive metal thin film. The properties of the metal coating and QCM allow the sensor to have fast response and fast recovery to moisture in the process gas stream. The properties of the metal-coated QCM also allow the sensor to be compact so it can be in-line in the gas distribution system and readily integrated into the process tools. This paper presents the principle of moisture detection using this technology. The experimental results of accuracy, limit of detection (< 1 ppb), and error analysis of this sensor in parallel with atmospheric pressure ionization mass spectrometry (APIMS) are presented. The experimental setup and procedures are described. The effect of an upstream gas purifier on its rate of response was also studied and the results are presented and discussed. The applications of this technology in semiconductor processing are briefly mentioned.* (CC: Clean Facility Operation/Procedures, Identification, Measurement, and Monitoring)

Williams, B.W., Multi-Resolution Processing for Random Vibration Control, V. 40, No. 1, p. 35, 1997. (Abstract—see Karshenas, A.M.)

Worth, D.B., A Method for Implementing Force-Limited Vibration Control, V. 40, No. 4, p. 34, 1997. NASA/*Goddard Space Flight Center (NASA/GSFC) has implemented force-limited vibration control on a controller which can only accept one profile. The method uses a personal computer-based digital signal processing board to convert force and/or moment signals into what appears to be an acceleration signal to the controller. This technique allows test centers with older controllers to use the latest force-limited control techniques for random vibration testing. The paper describes the method, hardware, and test procedures used. An example from a test performed at NASA/GSFC is used as a guide.* (DTE: Shock and Vibration, Test Tailoring)

X

Xu, M., Minimum Sampling Time/Volume for Liquide-Borne Particle Counters, V. 40, No. 6, p. 29, 1997. *A particle counter is an instrument that measures particles in all the fluid passing through its sensor, and a particle monitor measures particles only in a portion of the fluid. For liquid with an ultralow particle concentration, particles may not disperse uniformly in the liquid. Therefore, the concentrations may vary significantly from measurement to measurement if the sample volume is not large enough. To achieve the same precision, a minimum sampling time or minimum sample volume for a particle instrument needs to be specified. A Poisson distribution was used to describe the distribution of particle counts. Testing included a series of particle concentration measurements.* (CC: Identification, Measurement, and Monitoring)

Y

Yagai, M., N_2 Tunnel Wafer Transport System, V. 40, No. 1, p. 23, 1997. (Abstract—see Toda, M.)

Yoo, S-H., Isolation Ratio and Particle Performance Measurement of a SMIF System, V. 40, No. 6, p. 23,1997. (Abstract—see Liu, B.Y.H.)

STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION
(Required by 39 U.S.C. 3685)

Title of publication: JOURNAL OF THE INSTITUTE OF ENVIRONMENTAL SCIENCES (publication number 10522883). Date of filing: 10/9/97. Frequency: Bi-monthly (number of issues published annually: 6). Annual subscription price: $50. Mailing address and business headquarters: INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY, 940 East Northwest Highway, Mount Prospect, IL 60056-3444. Publisher: INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY. Editor: Janet A. Ehmann. Average number of copies each issue during the preceding 12 months: total number of copies, 4400; paid and/or requested circulation through dealers, none; mail subscription, 3343; total paid and/or requested circulation, 3343; free distribution by mail, carrier, or other means, samples, complimentary, other free copies, 852; total distribution, 4195; copies not distributed, 105; return from news agents, none; total 4300. Actual number of copies of single issue published nearest to filing date: total number of copies, 4300; paid and/or requested circulation through dealers, none; mail subscription, 3253; total paid and/or requested circulation, 3253; free distribution by mail, carrier, or other means, samples, complimentary, other free copies, 887; total distribution, 4140; copies not distributed, 160; return from news agents, none; total, 4300. I certify that statements made by me above are correct and complete. Signature of editor: Janet A. Ehmann

PS Form 3526, October 1994.